Article

Portraying the Water Crisis in Iranian Newspapers: An Approach Using Structure Query Language (SQL)

Farshad Amiraslani [1,*] and Deirdre Dragovich [2]

1   School of Geography & Environmental Sciences, Faculty of Life & Health Sciences, Ulster University, Coleraine BT52 1SA, UK
2   School of Geosciences, University of Sydney, Sydney, NSW 2006, Australia; deirdre.dragovich@sydney.edu.au
*   Correspondence: f.amiraslani@ulster.ac.uk; Tel.: +44-(0)792-892-4090

Abstract: Water is a valuable resource for which demand often exceeds supply in dry climates. Managing limited water resources becomes increasingly difficult in circumstances of recurring drought, rising populations, rapid urbanisation, industrial development, and financial constraints, such as occur in Iran. Newspapers both report on and influence people's understanding of water-related issues. An analysis was undertaken of two major Iranian daily newspapers over a 7-year period. Structure Query Language (SQL) was employed to identify relationships among a total of 1275 records/fields which were extracted from 84 water-related news items. They were analysed for message, contributor, spatiality and allocated space. Of the water-related items, wetlands comprised 33% (class), public awareness 54% (message), local level 56% (spatiality), and authorities 53% (contributor). Space allocation on each page was mostly <40% (94% of items). Four examples were highlighted of ambitious engineering projects adopted in response to water distribution issues. It is concluded that the general lack of educating messages about water use efficiency in rural areas and water consumption in cities does not assist in developing positive water-saving local behaviours. Newspapers could be a useful tool in a broader strategy for addressing and managing the demand side of the water crisis in Iran.

Keywords: water; newspapers; Iran; SQL

1. Introduction

Water challenges, including water quantity and quality, have been well documented in the past, including the most recent comprehensive global report [1]. These documents have portrayed national, regional, and international dimensions in relation to the political, economic, and ecological aspects of water resources across the world. In a recent global report, it was stated that a staggering 1.4 million people die annually due to diseases associated with pathogen-polluted drinking water and inadequate sanitation [1]; and 500 million people face severe water scarcity at all times [2]. The UN defines water scarcity as 'the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully.' [3]. Although this altered water availability in drylands is largely climate-controlled through low rainfall and recurring periods of frequently prolonged droughts, scarcity may also arise from social or economic demands and expectations [4].

The multifaceted nature of managing water availability, a crucial life source, has important political, social, economic and environmental ramifications which are exacerbated during periods of scarcity when water resources and their management begin to command attention in public consciousness and debate. At the local level, people's perception and knowledge of water issues generally has a strong although not exclusive reliance on lived experience, but at regional and national scales information is gained mainly from secondary (media) sources. Research has shown the role of media in portraying various aspects of environmental hazards affecting contemporary mankind e.g., [5–7]. What is clear, however,

is that little has been published on the communication endeavours, specifically those of the media, to indicate the way in which news and knowledge has been transmitted to the public. The success or otherwise of the media in its educating role is likely to influence the overall perception of the public towards water availability in their region or country.

Based on our literature review, analysis of the role of media in the representation of water issues in newspapers has attracted low attention at the global level. An early paper in 1977 [8], newspaper responses to flooding and erosion associated with high water events in the Great Lakes were documented. Later in 1980 [9], the narrations of Italian and British newspapers in response to severe flooding which occurred in Florence city (Italy) in 1966 were assessed. Only a limited number of international articles have been published since then, and our concern about the shortage of analytical assessment of water news is supported by another research [10]. Dominated by case studies in the developed countries, the role of the media in presenting water issues has covered various aspects of water-related topics from marine to hazards (Table 1). Even so, these assessments are limited compared with other environmental subjects such as climate change. No evaluation has been made of newspaper reporting of water issues in a country dominated by drylands. Our study aims to analyse water-related items in Iranian newspapers, in the context of increasing pressures on limited water resources in a developing country and the inevitable contestation over water distribution. Specific questions addressed are the page-space devoted to water-related issues, their spatial focus (local to international), the attributes of writers (columnists or authorities), and the nature of the reporting (public awareness, alarming or educational).

Table 1. Selected articles that have focused on water-related news.

Research Class	Research Topic	Country	Timeframe	Number of Articles/Posts	Number of Newspapers/Websites	Source
Marine	Shark	Australia	1 year (2016)	2018 Facebook posts	2,643 Facebook posts	[5]
	Whaling	Australia and Japan	3 months (15 December 2007–24 March 2008)	n/a	5	[11]
	Shellfish bacterial contamination	USA	1 year (2003–2014)	154	2	[12]
Hazards	Hurricane Katrina	USA	2 months (August 27, 2005, to November 9, 2005)	290	1	[6]
	Flooding	Nigeria	4 years (January 2012 and September 2016)	147	several	[13]
General	River-floodplain management	USA and Germany	10 years (1989–99 and 1990–2000)	94 and 53	2	[14]
	Dam project	Canada	15 years (1976–1992)	689	2	[7]
	Water resource management	Australia	1843 to 2011(four weeks in each year)	3526	1	[15]
	Potable water recycling	USA	2000–2016	158	several	[16]
	Water consumption	USA	2005–2015	n/a	several	[17]

2. Water and Media: An Iranian Perspective

Water resources in the eyes of Iranians have always been a precious asset whether from a religious, personal, or historical perspective [18]. Iran's civilisation was formed and expanded around rivers over past millennia, with most cities originating from an agriculturally based system which was completely dependent on riverine irrigation [19]. As Iran is a country with a predominantly arid and semiarid climate, water has always been a top priority for its people who have a long tradition of water management [20]. Qanats or underground water canals have historically been efficient in conserving water, and dams and water saving structures also attracted the attention of earlier Iranians as is attested by the remains of numerous water structures built from about 240 AD [21].

Similar to other dramatic socio-economic changes in the 20th century, however, the waterscape of Iran has also been altered. Large-scale dams have been erected, rivers diverted, traditional water sharing rules abolished, wetlands dried up, and precipitation patterns changed while water demand and withdrawals have increased substantially. The major cause has been unprecedented population growth [20] leading to the expansion of cities, increased industrialisation, devastation of simple rural lifestyles and disruption of traditional water management systems that had been in place for centuries [22,23]. These changes have brought about a new lifestyle in Iran and dictated new behaviours, seen commonly in other countries, including higher water consumption for daily personal care and leisure. Water consumption in both urban and rural Iran is now very high compared to the global norms [24,25]. Across the country, infrastructure (e.g., mega-dams) has been expanded to keep pace with these new demands though environmental consequences have been considerable [26,27].

Water issues in Iran, including technical aspects in relation to streamflow and water quality, have received attention from researchers (e.g., [28,29] for Western Iran; [30,31] for an overview on Iran) but the role of media in transmitting information on water management issues has not been investigated. In developing countries like Iran, newspapers are still the dominant conduits for providing daily news at various scales from local to global. This situation is expected to change in future given the rise of digital media and digital literacy of people around the world. But for now, older generations still trust and rely on newspapers for information on current issues. Our aim here is to review the role of Iranian newspapers in transmitting water information to the public by focusing on two Persian-language daily newspapers. The objective is to examine newspaper reporting of water-related issues specifically within Iran.

3. Data and Methods

We designed our research based on two data-related collections: *Dataset* and *Database*.

3.1. Dataset

Our dataset was derived from two print-based newspapers spanning the 7-year period from 2007 to 2014. Unintentionally, the timeframe selected in our study coincided with other research conducted on the role of newspapers: for example, pharmaceutical pollution in the aquatic environment for the period of 2007 to 2014 in USA [32]; climate change impacts on health in Canada between 2005 and 2015 [33]; debates on climate engineering in the period 2006–2011 [34]; and natural disaster assessment in Canada for the period 1996–2017 [35].

We selected two major daily-based mainstream Persian-language newspapers: IRAN (nationally released) and Hamshahri (provincially released). The literal translation of 'Hamshahri' is 'fellow citizen'. These two newspapers present environmental news (including water) more frequently than other newspapers in Iran and both are fully or partially funded by the government. Neither newspaper announces its exact daily circulation of printed issues which is perhaps due to their being business rivals. For Hamshahri, as one of the four largest Iranian daily newspapers, a circulation of about 400,000 was cited in 2014 [36]. Both newspapers have released news in printed and online forms in recent

years, though we covered printed issues only. Comparatively, both newspapers publish environmental news in Persian with more or less the same information in terms of coverage and style. For developing the dataset, we first defined 'water' news to cover all news items that were exclusively devoted to the water-related themes of "lake, wetland, irrigation, drinking water, river, groundwater, dam, spring, water pollution, water resources, watershed management" (Table 2). Then, we identified relevant news items based on the above-mentioned themes and underlined the key water-related words. This process was repeated at least twice to ensure that no words had been missed. Our dataset included a total of 85 news items published on the nominated water-related themes.

Table 2. Examples of water news headlines in Iranian newspapers (*Translated to English*).

Water News Headlines	Remarks
Watershed management schemes for southern flank of Alborz Mountain	Alborz is a province adjacent to Tehran which has experienced an unprecedented population growth in recent years (from 2.1 m in 2006 to 2.7 m in 2016 [37]
Forty years of negligence in withdrawing groundwater in Qazvin plain	Qazvin plain is an agricultural area located in Qazvin province. Over the decade to 2011, watertable level declined by approx. 17 m [38]
Water resources in Tehran: nitrate level in the water	The topic has been recurring mainly among the public. No further scientific evidence has recorded high nitrate/nitrite levels in Tehran drinking water (e.g., [39])
Evaporation of 90 cm of water of Urumia Wetland every year	Please refer to Section 5.2.3 for further details

3.2. Database

Our database was comprised of a spreadsheet file. We did not employ any specific filtering to exclude words from our dataset. Then, we extracted those underlined words (known as 'records' in a relational database system) and entered them into a spreadsheet file under the following columns (known as 'fields' in a relational database system):

Message: We defined three messages: Public Awareness, Educating, Alarming.

Contributor: We considered three columns: Columnist, Researcher, Authority.

Spatiality: We considered four spatial levels: Local, Provincial, National, International.

Allocated space: For this column, we measured the proportion of space (10% to 100%) on a page which was allocated to water news.

By identifying and extracting words from our dataset, a total of 1275 records/fields were entered into a spreadsheet file to create a database (Table 3). A categorical system of existence/non-existence for the designated field is listed as zero (0) absent and one (1) present. Table 3 records an example of a news item with a public awareness message, contributed by an authority, and having national spatiality.

Table 3. A cross-section of the database prepared for this research.

Newspaper	Date	Subject	Allocated Space	Public Awareness	Educating	Alarming	Columnist	Researcher	Authority	Local	Provincial	National	International
IRAN	… ..	Water	0.8	1	0	0	0	0	1	0	0	1	0

A relational database management system (RDBMS) was used here: this is a system composed of algorithms that manipulate the data based on a series of rules, constraints, and filters [40]. An end-user can employ these system capabilities to compute, manage, retrieve, and update data in RDBMS at any time [40]. This system also utilises the statements and expressions of the Structured Query Language (SQL) to provide end-users with the possibility to make queries from multiple tables at the same time.

For data analysis, we employed the rules and commands of SQL to explore relationships among the various fields (columns). For instance, we could explore whether a relationship existed among articles that were translated from English and published in the IRAN newspaper which aimed at improving public awareness on any water-related theme. While full descriptions of data extraction and analysis of print-based news have not always been included in the research literature, some investigators have used measures such as article coding e.g., [32], framing e.g., [13], or content analysis e.g., [14]. These existing approaches do not establish linkages between unrelated fields, as we were able to do using the SQL method. In particular, some of our queries consisted of simultaneous four-field relationships (Message/Contributor/Spatiality/Allocated space). Without SQL coding in place extracting such multiple associations from 1275 cells would not be feasible, so our new approach has advantages.

4. Results

4.1. Water in the News

We sub-divided the 85 news items into three different classes, namely 'water management', 'Water bodies' and 'Others'. Table 4 illustrates the water-related classes and sub-classes that were discussed in the newspapers. Overall, the proportional share of the three topics of 'water bodies', 'water management' and 'others' was 48%, 40% and 12%, respectively. Wetlands occupied 33% of all water-related articles published in newspapers, followed by dams (14%) and water table (10%). Issues on agricultural water (7%) and rivers (6%) also received attention. The 'others' class included ten general water news items published on variety of matters.

Table 4. Water-related news in the Iranian newspapers.

Class	Sub-class	No.	Class	Sub-Class	No.
Water management	Dam	12	Water bodies	Wetland	28
	Water table	9		River	5
	Agricultural water	6		Lake	4
	Drinking water	3		Sea	3
	Urban water	2		Ocean	1
	Water transfer	2		*Sub-total*	*41*
	Sub-total	*34*	Others	e.g., events	10

4.2. Coverage of News: Messages and Spatial Scales

We categorized the types of messages in the newspapers into three: public awareness, alarming and educating. The majority of news items were classified as public awareness (54%) or alarming (44%), with only 2% being in the educating group (Table 5). In terms of spatial coverage, most news items were related to local (56%) and national (30%) levels, rather than provincial (6%) or international (8%) (Table 6).

Table 5. Overall findings of water news in IRAN and Hamshahri newspapers (n=85 items).

Public Awareness (46)								
Columnist	16	Local	7	Provincial	-	National	6	International	3
Researcher	4	Local	1	Provincial	-	National	3	International	-
Authority	26	Local	17	Provincial	2	National	5	International	2
Alarming (37)								
Columnist	16	Local	10	Provincial	1	National	5	International	-
Researcher	3	Local	2	Provincial	-	National	1	International	-
Authority	18	Local	10	Provincial	2	National	6	International	-
Educating (2)								
Columnist	2	Local	-	Provincial	-	National	-	International	2
Researcher	-	Local	-	Provincial	-	National	-	International	-
Authority	-	Local	-	Provincial	-	National	-	International	-

Table 6. Number of water-related messages at different spatial levels (n = 85).

Message	Scale			
	Local	**Provincial**	**National**	**International**
Public Awareness (46)	25	2	14	5
Alarming (37)	22	3	12	-
Educating (2)	-	-	-	2
Total (85)	**47**	**5**	**26**	**7**

Regarding the contributors to writing news on water, we considered three self-describing groups as authorities, researchers, and columnists. It was found that the authorities (53%) had the highest share followed by columnists (38%) and researchers (9%) (Table 5). In terms of space allocation, the largest spaces allocated for water news were 40% or less of a full page (94%) and the smallest share was represented by one article that only covered 8% of a full page.

Using SQL rules, we could make relationships between relevant parameters. We found that Authorities wrote the highest number of local news with public awareness. Local issues presented with alarming messaging were contributed equally by columnists and authorities. However, columnists wrote two international news items with educating messages (Table 5).

5. Discussion

5.1. Overview

The SQL-based data analysis that was employed in this research assisted in identifying relationships among the individual parameters. For instance, we could check how many *columnists* wrote news on *public awareness* at the *local* level by shuffling 85 *articles* (among 1275 data entries) (Table 5). Based on the results, we conclude an overall inadequacy of representation of the 'water' subject in the two Iranian newspapers by any standard for print media. For a dryland country like Iran with high domestic water consumption e.g., [25] and a water crisis across most parts of the country, media would be expected to be more proactive transmitters of knowledge, solutions, and critical news. With few exceptions, the allocated spaces for water issues in 94% of cases were 40% or less of a full page in a given newspaper. These proportions do not reflect the importance of water and

its socio-economic challenges in contemporary Iran. In addition, there was an absence of either Alarming or Educating images to illustrate water problems.

We considered four spatial levels: local, provincial, national, and international. Other research has classified news items into the five spatial groups of local, regional, national, European, and global [41]. In our research, most news items covered local issues and provincial news was the least important compared to the other spatial levels. Of the 85 articles considered, only five covered provincial news. This is another unusual finding as nearly half of the provinces in Iran are regarded as desertified areas in which rainfall is low, infrequent and unreliable [27]. Perhaps water problems are accepted as a 'normal' part of life in a dry climate and are not therefore deemed noteworthy. Also, long-term 'slow' problems like gradually declining water availability often attract less newspaper attention than dramatic short-term events like floods.

The most unexpected finding related to the absence of attempts to educate the public on water matters including water conservation. Only two educational news items regarding water were published over the total period of 7 years. This absence of an educational aspect to water-related news was striking, especially for a dry country having one of the highest daily domestic water consumption rates in the world. In a rural area in Iran, a survey conducted in 33 villages comprising 653 households showed that the average domestic consumption of 121.7 L per capita per day was three times more than in Latin America and South India and 1.5 times more than in China ([25]: Table 6). The same study also indicated a very high consumption rate among Shiraz urban residents of 325 L per capita per day. Research indicates that Iranians living in urban areas misunderstand water abundance in their region, although the water administrators attempt to persuade them to decrease their consumption [24]. Such misconceptions about water availability and use can be seen in all types of daily activities. As a foreign visitor, Foltz observed the strange activity of grasses being watered in an Isfahan city park during a summer when people were suffering from severe water shortages: " . . . ..*I was profoundly struck by the irony of seeing city gardeners water grassy park lawns during the scorching mid-day heat,... I also saw unattended hoses and faucets running full force into the ground, ... This was during a period when some neighborhoods were entirely without water for days at a time*" ([18], p. 368). As there are no recycling systems in place for park watering, this use and its timing during the peak evaporation hours of the day depletes the quantity of potable water available for residents.

A very low contribution from researchers (9%) in writing news in all messages (public awareness, alarming and educating) was observed here. This finding is similar to that of research conducted in Australia in which only 9% of contributors were academics or researchers while 33% were politicians or government representatives or water authorities [10]. In another Australian study, it was found that academics and NGOs rarely contributed to the Sydney Morning Herald newspaper between 1843 and 2011 [15]. Some Australian newspapers have an environmental editor or writer, and other newspaper reporters often base their articles on academic or research results including quoted comments from academics and researchers. In Greece also, researchers' share was only 1–3% of news on Marine Protected Areas [41]. For Iran, one of the reasons for such lack of interest among researchers and university lecturers is that writing for newspapers is ignored for academic promotion: researchers are thus unwilling to make contributions to newspapers [42]. As a result, 'authorities' followed by 'columnists' were by far the most frequent writers on water issues in Iran (Table 5). The large share of contributions by authorities can be attributed to newspapers inviting staff in these authorities to write or be interviewed. Such individuals normally have access to first-hand unpublished and raw data gathered by their organisations and are aware of updated legislation and regulations.

5.2. Controversial News Items

Columnists and journalists are often eager to highlight or exaggerate situations by adding controversial or attractive headlines or events that they imagine will interest their readers [9]. In addition, journalists in the new digital era have access to more sophisticated

tools and archives for visualisation to communicate information and to facilitate maximum comprehension [43]. "Graphical journalists will often draw a reader's attention to the most salient aspect of a data story by presenting or arranging graphical elements in a perceptually advantageous manner" ([43], p. 304). However, illustrations were notably absent from water-related newspaper reporting in our study.

Our content analysis revealed that the topics of wetlands, dams, and water table constituted the largest number of water-related news items covered in Iranian newspapers (Table 4). In order to elaborate on a sample of news items at varying spatial scales, we focus on four examples each of which reflects a decline in water resources.

5.2.1. "Wet Khuzistan is Thirsty"

One of the most dramatic headlines in our studied newspapers referred to the situation in Khuzistan province and is translated above. Ironically, this statement portrays very well the province's modern-day water-related circumstances which contrast with its water situation in the past. This single news item covered around half a page and was classified as having been written by authority at a provincial level.

Archaeological excavations in contemporary Khuzistan highlight the importance of this Western plains and mountainous area of Ancient Iran as the major livestock-rearing and agricultural location in the Near East [44,45]. Human settlers were attracted to the availability of fertile lands, water resources and the surrounding Zagros forests [21], with initial domestication of goats taking place around 10,000 years ago [46]. Khuzistan was also a transit zone for international trade [21]. In addition to its historical prominence, the province is presently well-known for two major resources that have shaped contemporary Iran, namely oil and water.

Historical records indicate that the early dams and bridges built over rivers in this area were among the great engineering achievements of antiquity [21]. In recent decades, this practice of building dams has continued as a result of demand for water to irrigate vast plains and arable lands, the need to control frequent floods, and the desire to generate hydroelectricity for the benefit of the country as a whole. Some hydrological assessments of the region have been published indicating that water resources are abundant in Khuzistan province as it is the end-point or passage of major internal and trans-boundary rivers [28,29]. Over 30% of Iran's total surface water of 94 billion m^3 flows into this province [29], encouraging the construction of several major (controversial) mega-dams many of which were designed and built in the late 1950s [23]. The news headline of 'Wet Khuzestan is thirsty' probably points to two issues: first, despite the presence of these mega-dams, they are barely functional during long droughts and most of the province's inhabitants suffer from poor-quality drinking water during the summer months [29]. This became a serious challenge during 2020 when local people asked the government for access to water of better quality. In response, the government launched a mega-project to transfer water to the surrounding villages. Second, downslope catchments are 'thirsty' due to the lack of auxiliary canals and farmers desperately need water to irrigate their arable lands. Hydrological miscalculations and misinterpretations even gave rise to a debate in Iran to export water from Khuzistan to neighbouring countries in the Persian Gulf three decades ago [47]. Regardless of whether this weird proposition was merely regional political posturing or domestic rhetoric or an extension of an olive branch to the neighbours [47], it has never materialised.

5.2.2. The Caspian Sea Water Transfer Plan.

As the largest inland lake in the world, the Caspian Sea occupies an area of about 400,000 km^2 in West Asia and is surrounded by Russia, Azerbaijan, Iran, Turkmenistan, and Kazakhstan [48]. At the regional level in the eyes of its surrounding beneficiaries, this large lake is an important navigation route to the Black Sea and a great reserve of marine animals such as sturgeon fish and freshwater seals [48]. At both regional and international levels, however, it is also considered as one of the largest oil reserves in the world [48,49].

Iran has a 12–13% share of the Caspian seabed [48] but is willing to divide the Caspian into equal divisions of 20% of the sea floor and surface [49]. Aside from these littoral and marine disagreements at a regional level, a new storyline has arisen and been led by media at the national level. This controversial issue involves transferring water from the Caspian Sea, located in the north, to the central arid provinces in Iran. In our study, we found only one newspaper reported this issue (in 2011), although several years earlier a scientific paper suggested using water from the Caspian Sea to provide supplementary irrigation for growing barley in Iran [50]. This may be just another strange plan in the general water management system in Iran but, because of its broad-ranging potential outcomes, it warrants concern. Almost all past Iranian governments have viewed the Caspian Sea as a potential free water resource that could be transferred physically to the central deserts for irrigation and drinking water purposes, although desalination would be necessary. Even so, pundits see this as an ambitious political move and others as a 'mission impossible' economically. However, from an ecological viewpoint, it would inflict major disruptions in ecosystem services, impacting on a diverse range of ecosystems across several provinces from pristine forests to rangelands to wetlands. Moreover, as this matter has not been discussed seriously with the Caspian Sea's other national beneficiaries, their reactions are unknown and may well not be positive. The Caspian Sea and other water transfer plans have been headlines for some time in Iranian newspapers and debates are on-going. This item was counted twice among all news items and was categorised in two public awareness and alarming categories. Interestingly, though, another national water transfer plan has been pursued, after the end of our current research timeframe (2014), in which desalinated water has been transferred from the Persian Gulf (South) to three dry inland provinces to provide water for industry and agriculture. The first phase was completed in 2020 [51].

5.2.3. "Evaporation of 90 cm of Water of Urumia [Urmia] Wetland Every year"

As the birthplace of the formation of the international Ramsar Convention on Wetlands, Iran itself is suffering from the degradation of wetlands across its territory. In Table 4, it was shown that the largest portion of news items in two newspapers related to wetlands (33%). This figure reflects the realities on the ground (personal experience—FA) which indicate that sensitivities among the public and decision-makers to drying of wetlands have risen sharply in recent years. As the most adversely affected of Iranian wetlands, the Urumia Wetland (lake) located in the north-west is one of the important wetlands listed in the Ramsar Wetland Convention. Although the lake's area fluctuates its extent of about 5,000 km^2 had decreased to around 500 km^2 by 2013 [52]. The wetland has been altered dramatically as a result of anthropogenic (e.g., intensified agriculture) and natural (e.g., drought) factors over the past decade [53]. From a climate perspective, mean precipitation in the Urumia basin has decreased by 9.2%, and average maximum temperature increased by 0.8^{0}C, over the 40-year period 1964–2005 [54]. In addition to climate-generated water reduction, environmental critics insist the inappropriate construction of a bridge over the wetland has cut the water flowing between two separate sections, and others point to the construction of dams in the upper basin designed to divert water for farming. Along with decreasing flows into the wetland and increasing groundwater extraction, the diminishing lake has become increasingly saline, of concern for its *Artemia* species. The sensitivity of this important wetland prompted Iranian President Rouhani, as his first national environmental order upon taking office in 2013, to launch a specialised task group to investigate the issue [42]. A relief plan including both technical and socio-economic activities was prepared, and a sizeable fund was allocated to implement major proposed on-the-ground projects such as the expansion of plantations, construction of water diversion canals, and improvement in agricultural practices. Local farmers were asked to minimise their water dependency on rivers flowing to the wetland and to substitute current crops with types having lower water consumption. A series of projects, including those funded by FAO, were designed to divert rivers or release water from the existing dams to the wetland. However, exceptional rainfalls in 2019–2020 probably (unfortunately) lessened

concerns about long-term desiccation of the wetland. According to an authenticated report in 2019, for instance, almost 2700 MCM^3 of water poured into the wetland from rainfall and river flows, compared to just 10 MCM^3 water saved/compensated by other human relief activities [55]. The lake has been at least temporarily revitalised to an area of approximately 3,000 km^2 [52] but this short-term flooding does not solve its long-term water decline.

5.2.4. Inter-Provincial Water Transfer Plan: "Transferring water from Chahar-Mahal and Bakhtiari Province to Isfahan . . . "

Despite only one news item appearing about this inter-provincial water transfer plan, it is another challenging and contentious matter at the national level. The translated news headline reads as "*Transferring water from Chahar-Mahal and Bakhtiari Province to Isfahan to resolve water problems in Isfahan*". Such inter-provincial water transfer plans have always become highly politicised debates in Iran. The Chahar-Mahal and Bakhtiari Province (CMBP) is one of the western highland provinces which receives a reasonably high amount of precipitation annually (ranging from 1,400 mm in the mountains to about 250–300 to 500 mm in drier parts). In the early 1950s, a plan was proposed to transfer water from CMBP to the central provinces including Isfahan through an inter-provincial water tunnel [22]. The same inter-provincial water transfer plan was implemented to bring Karun river water using the Kuhrang tunnels into central Iran (to Isfahan, Yazd and Kerman). These inter-provincial water transfers exert pressure on the water balance in the source area, impact on the hydrological regime of the sink areas, and disrupt the traditional rights and practices of water management [22]. Across rural Iran, traditional water division systems have been in place for hundreds of years. In these systems, a trusted local person was tasked to control the amount of water shared among all stakeholders and beneficiaries without any disputes. For instance, in Isfahan province, a simple local technique has been used to share water for centuries: " . . . *the distribution of water followed the Tomar, a document which it is claimed dates from the sixteenth century. In this the discharge of the Zayandeh river was divided into 33 parts which were then allotted in a specified fashion to the eight major districts within the region*" ([23], p. 421). However, the combination of population growth and drought conditions since 2000 in many parts of Iran have highlighted conflicts over scarce water supplies. Utilising technology to provide greater accuracy about streamflow [56] and water availability may assist in resolving some of these issues.

5.2.5. Water-Related News Items: Concluding Remarks.

Each of these four examples of large-scale plans reported in news items responds to growing populations and their associated water consumption in Iranian cities which are the destinations for increasing rural-urban migration. While urban settlers seek higher living standards and utilities (e.g., piped water), rural farmers are simultaneously asking for more water to be released to their lands which feed these growing populations and are pivotal for national food security. However, water efficiency in Iranian agriculture is around 35%, and agriculture is already utilizing over 90% of all water resources [57]. Therefore, instead of these costly large-scale plans, the wise move would be to focus on improving demand issues by increasing water use efficiency, installing modern irrigation systems, emphasising sustainable agriculture, and improving urban understanding of water use and availability.

As noted above, water-related issues in Iran are contentious because of limited water resources, increasing demand from a rapidly growing and urbanising population, and competition between urban and rural consumers for an essential resource. Satisfactorily managing water availability, distribution and allocation in such a developing economy with limited financial resources is difficult and made more so by climate change. In Iran's case, a major government response has been planning and construction of large water-storage and water-distribution facilities which may not benefit all stakeholders. Analysis of scientific papers and reports as well as field visits (FA) suggest a slow pace of non-engineering responses in rural areas such as an emphasis on local water harvesting projects; increased water use efficiency in agriculture by reducing soil erosion, selecting crops for

low water usage, installing drip irrigation systems, and monitoring crop water requirements; and, in urban areas, considering water recycling and encouraging careful water use in domestic settings.

The timeframe of this research (2007–2014) coincided with a period of very challenging debates surrounding the Iranian nuclear issue at national and international levels. It would be expected that a large proportion of newspaper reporting would be allocated to this issue and the consequent international financial sanctions which clouded the country and its economy. Not unreasonably, newspapers focused their attention on this issue even though water has been and remains a recurring and critical theme in the country's development. This led to an overall inadequate representation of water-related news items in the two mainstream newspapers studied.

Both rural and urban populations in Iran, as the main daily beneficiaries of water availability, need to be aware of drought spells, water supply bottlenecks, and other realities of water resources in their local or regional environment, and not develop a persistent acceptance of water shortages which may become more intense with climate change. In this, mass media like newspapers are powerful conduits for informing people in plain language about water issues and are potentially able to disseminate information that may change attitudes and behaviours towards economising on water consumption. Even though the two studied newspapers have provincial and national distribution, their reporting emphasised water-related matters at local and provincial scales. It could be argued that the emphasis on alarming rather than educating messages (Table 5) constituted an indirect mechanism for promoting changes in attitudes and behaviours—however, people need advice on what change to seek and the most effective way to generate desired outcomes. Only two news items were classed as Educating and both were international. A higher proportion of educating news items would assist in this process.

6. Conclusion

Water availability is a persistent problem in drylands and an issue that is not readily resolved. As developing economies like Iran generally have pressures on physical and financial resources, both national and local responses could be directed more towards water scarcity. Our study of two mainstream daily (print) newspapers over a 7-year period showed an unexpectedly low number of water-related news items, given the drought conditions and water shortages experienced at the time. Iranian newspapers and other media could assist in improving water management by placing greater emphasis on the educational component of reporting (only 2% in our study) and by investigating whether including illustrations and descriptions of desirable conservation behaviours and strategies would encourage a reduction in water usage. Additional local agricultural extension programs could also assist communities with water-saving plans of action. Newspapers, whether digital or print-based, could be a useful tool in a broader strategy for addressing and managing the demand side of the water crisis in Iran.

References

1.	GEO-6. The UN Environment's Sixth Global Environment Outlook. 2019. Available online: https://www.unenvironment.org/resources/global-environment-outlook-6 (accessed on 14 March 2021).
2.	Mekonnen, M.M.; Hoekstra, A.Y. Four billion people facing severe water scarcity. *Sci. Adv.* **2016**, *2*, e1500323. [CrossRef]
3.	UN, undated. United Nations International Decade for Action Water for Life. Available online: https://www.un.org/waterforlifedecade/scarcity.shtml (accessed on 17 March 2021).
4.	UNCCD. Desertification: The invisible frontline. Secretariat of the United Nations Convention to Combat Desertification, Second edition, Bonn Germany. 2014. Available online: https://www.unccd.int/sites/default/files/documents/12112014_Invisible%20frontline_ENG.pdf (accessed on 14 March 2021).
5.	Le Busque, B.; Roetman, P.; Dorrian, J.; Litchfield, C. An analysis of Australian news and current affair program coverage of sharks on Facebook. *Conserv. Sci. Pract.* **2019**, *1*, e111. [CrossRef]
6.	Miller, D.S. Returning home and uncertainty in the local newspaper: Risk narratives and policy decisions in the immediate aftermath of Hurricane Katrina. *JPMSP Fall* **2007**, 81–98.
7.	de Loë, R.C. Dam the news: Newspapers and the Oldman River Dam project in Alberta. *J. Environ. Manag.* **1999**, *55*, 219–237. [CrossRef]
8.	Needham, R.D.; Nelson, J.G. Newspaper response to flood and erosion hazards on the North Lake Erie Shore. *Environ. Manag.* **1977**, *1*, 521–540. [CrossRef]
9.	Alexander, D. The Florence floods: What the papers said. *Environ. Manag.* **1980**, *4*, 27–34. [CrossRef]
10.	Hurlimann, A.; Dolnicar, S. Newspaper coverage of water issues in Australia. *Water Res.* **2012**, *46*, 6497–6507. [CrossRef]
11.	Kimura, T. Flinders University Newspaper Reporting of Whaling in Australia and Japan: A Comparative Content Analysis. *NV* **2014**, *6*, 173–198. [CrossRef]
12.	Suldovsky, B.; Arbor, E.; Skillin, V.; Lindenfeld, L. Communicating Environmental Risks: Local Newspaper Coverage of Shellfish Bacterial Contamination in Maine. *Front. Commun.* **2018**, *3*. [CrossRef]
13.	Adekola, O.; Lamond, J. A media framing analysis of urban flooding in Nigeria: Current narratives and implications for policy. *Reg. Environ. Chang.* **2017**, *18*, 1145–1159. [CrossRef]
14.	Hale, B.W. Using Newspaper Coverage Analysis to Evaluate Public Perception of Management in River-Floodplain Systems. *Environ. Manag.* **2010**, *45*, 1155–1163. [CrossRef]
15.	Wei, J.; Wei, Y.; Western, A.; Skinner, D.; Lyle, C. Evolution of newspaper coverage of water issues in Australia during 1843–2011. *Ambio* **2015**, *44*, 319–331. [CrossRef] [PubMed]
16.	Ormerod, K.J.; Silvia, L. Newspaper Coverage of Potable Water Recycling at Orange County Water District's Groundwater Replenishment System, 2000–2016. *Water* **2017**, *9*, 984. [CrossRef]
17.	Quesnel, K.J.; Ajami, N.K. Changes in water consumption linked to heavy news media coverage of extreme climatic events. *Sci. Adv.* **2017**, *3*, e1700784. [CrossRef]
18.	Foltz, R.C. Iran's Water Crisis: Cultural, Political, and Ethical Dimensions. *J. Agric. Environ. Ethics* **2002**, *15*, 357–380. [CrossRef]
19.	Spooner, B. City and river in Iran: Urbanization and irrigation of the Iranian plateau. *Iran. Stud.* **1974**, *7*, 681–713. [CrossRef]
20.	Tahmasebi, A. Indigenous knowledge for water management in Iran's dry land—Siraf. *Int. J. Environ. Stud.* **2009**, *66*, 317–325. [CrossRef]
21.	Soucek, S. Arabistan or Khuzistan. *Iran. Stud.* **1984**, *17*, 195–213. [CrossRef]
22.	Molle, F.; Mamanpoush, A. Scale, governance and the management of river basins: A case study from Central Iran. *Geoforum* **2012**, *43*, 285–294. [CrossRef]
23.	Beaumont, P. Water Resource Development in Iran. *Geogr. J.* **1974**, *140*, 418–431. [CrossRef]
24.	Bagheri, A.; Hjorth, P. A FRAMEWORK FOR PROCESS INDICATORS TO MONITOR FOR SUSTAINABLE DEVELOPMENT: PRACTICE TO AN URBAN WATER SYSTEM. *Environ. Dev. Sustain.* **2006**, *9*, 143–161. [CrossRef]
25.	Keshavarzi, A.R.; Sharifzadeh, M.; Kamgar Haghighi, A.A.; Amin, S.; Keshtkar, S.; Bamdad, A. Rural domestic water consumption behaviour: A case study in Ramjerd area, Fars province, I.R. Iran. *Water Res.* **2006**, *40*, 1173–1178. [CrossRef] [PubMed]
26.	Amiraslani, F.; Dragovich, D. Forest management policies and oil wealth in Iran over the last century: A review. *Nat. Resour. Forum.* **2013**, *37*, 167–176. [CrossRef]
27.	Amiraslani, F.; Dragovich, D. Combating desertification in Iran over the last 50 years: An overview of changing ap-proaches. *J. Environ. Manag.* **2011**, *9*, 1–13. [CrossRef] [PubMed]
28.	Masih, I.; Ahmad, M.-U.-D.; Uhlenbrook, S.; Turral, H.; Karimi, P. Analysing streamflow variability and water allocation for sustainable management of water resources in the semi-arid Karkheh river basin, Iran. *Phys. Chem. Earth Parts A/B/C* **2009**, *34*, 329–340. [CrossRef]
29.	Afkhami, M.; Shariat, M.; Jaafarzadeh, N.; Ghadiri, H.; Nabizadeh, R. Regional water quality management for the Karun?Dez River basin, Iran. *Water Environ. J.* **2007**, *21*, 192–199. [CrossRef]
30.	Amiraslani, F.; Caiserman, A. Contemporary water resource management and its role in tackling land degradation and desertification in Iran. In *Standing up to Climate Change: Creating Prospects for a Future in Rural Iran*; Springer: Cham, Switzerland, 2020; pp. 65–87. [CrossRef]
31.	Mirzavand, M.; Bagheri, R. The water crisis in Iran: Development or destruction? *WWP* **2020**, *6*, 89–97. [CrossRef]

32. Blair, B.; Zimny-Schmitt, D.; Rudd, M.A. U.S. News Media Coverage of Pharmaceutical Pollution in the Aquatic Environment: A Content Analysis of the Problems and Solutions Presented by Actors. *Environ. Manag.* **2017**, *60*, 314–322. [CrossRef]

33. King, N.; Bishop-Williams, K.E.; Beauchamp, S.; Ford, J.D.; Berrang-Ford, L.; Cunsolo, A.; IHACC Research Team; Harper, S.L. How do Canadian media report climate change impacts on health? A newspaper review. *Clim. Chang.* **2019**, *152*, 581–596. [CrossRef]

34. Scholte, S.; Vasileiadou, E.; Petersen, A.C. Opening up the societal debate on climate engineering: How newspaper frames are changing. *J. Integr. Environ. Sci.* **2013**, *10*, 1–16. [CrossRef]

35. Choudhury, M.-U.-I.; Haque, C.E. Interpretations of Resilience and Change and The Catalytic Roles of Media: A Case of Canadian Daily Newspaper Discourse on Natural Disasters. *Environ. Manag.* **2018**, *61*, 236–248. [CrossRef]

36. Lemańczyk, S. Science and National Pride: The Iranian Press Coverage of Nanotechnology, 2004–2009. *Sci. Commun.* **2014**, *36*, 194–218. [CrossRef]

37. City Population, Undated. Alborz. Available online: citypopulation.de/en/iran/prov/admin/30_alborz/ (accessed on 14 March 2021).

38. Babaee, S.; Mousavi, Z.; Masoumi, Z.; Malekshah, A.H.; Roostaei, M.; Aflaki, M. Land subsidence from interferometric SAR and groundwater patterns in the Qazvin plain, Iran. *Int. J. Remote. Sens.* **2020**, *41*, 4780–4798. [CrossRef]

39. Salari, A.; Khanzadi, S.; Rezaei, Z. Nitrate and nitrite concentration in the drinking water of some universities in Tehran. *JNFH* **2020**, *8*, 141–144. [CrossRef]

40. Arvanitis, L.G.; Ramachandran, B.; Brackett, D.P.; Rasol, H.A.-E.; Du, X. Multiresource inventories incorporating GIS, GPS and database management systems: A conceptual model. *Comput. Electron. Agric.* **2000**, *28*, 89–100. [CrossRef]

41. Dikou, A.; Dionysopoulou, N. Communicating a Marine Protected Area Through the Local Press: The Case of the National Marine Park of Alonissos, Northern Sporades, Greece. *Environ. Manag.* **2011**, *47*, 777–788. [CrossRef] [PubMed]

42. Amiraslani, F.; Caiserman, A. From air pollution to airing pollution news: Multi-layer analysis of the representation of environmental news in Iranian newspapers. *J. Int. Commun.* **2018**, *24*, 262–282. [CrossRef]

43. Grainger, S.; Mao, F.; Buytaert, W. Environmental data visualisation for non-scientific contexts: Literature review and design framework. *Environ. Model. Softw.* **2016**, *85*, 299–318. [CrossRef]

44. Abdi, K. The Early Development of Pastoralism in the Central Zagros Mountains. *J. World Prehistory* **2003**, *17*, 395–448. [CrossRef]

45. Lamberg-Karlovsky, C. The earliest communities of Iran. *Iran. Stud.* **1969**, *2*, 2–7. [CrossRef]

46. Zeder, M.A.; Hesse, B. The Initial Domestication of Goats (Capra hircus) in the Zagros Mountains 10,000 Years Ago. *Science* **2000**, *287*, 2254–2257. [CrossRef]

47. Taremi, K. The role of water exports in Iranian foreign policy towards the GCC. *Iran. Stud.* **2005**, *38*, 311–328. [CrossRef]

48. Nadim, F.; Bagtzoglou, A.C.; Iranmahboob, J. Management of Coastal Areas in the Caspian Sea Region: Environmental Issues and Political Challenges. *Coast. Manag.* **2006**, *34*, 153–165. [CrossRef]

49. Bahgat, G. Energy security: The Caspian Sea. *Min. Energy Raw Mater. Rep.* **2005**, *20*, 3–15. [CrossRef]

50. Ghadiri, H.; Dordipour, I.; Bybordi, M.; Malakouti, M. Potential use of Caspian Sea water for supplementary irrigation in Northern Iran. *Agric. Water Manag.* **2006**, *79*, 209–224. [CrossRef]

51. Jalilov, O. Iran launches first phase of water transfer from Persian Gulf. *Caspian News*. 8 November 2020. Available online: https://caspiannews.com/news-detail/iran-launches-first-phase-of-water-transfer-from-persian-gulf-2020-11-8-56/ (accessed on 14 March 2021).

52. Tehran Times. As Lake Urmia Replenishes Artemia Returns to the Lake. 6 May 2019. Available online: teh-rantimes.com/news/435542/As-Lake-Urmia-replenishes-Artemia-returns-to-the-lake (accessed on 14 March 2021).

53. Eimanifar, A.; Mohebbi, F. Urmia Lake (Northwest Iran): A brief review. *Aquat. Biosyst.* **2017**, *3*, 5. [CrossRef]

54. Delju, A.H.; Ceylan, A.; Piguet, E.; Rebetez, M. Observed climate variability and change in Urmia Lake Basin, Iran. *Theor. Appl. Clim.* **2012**, *111*, 285–296. [CrossRef]

55. ISNA. Iranian Students' News Agency. 2019. Available online: www.isna.ir (accessed on 6 May 2019).

56. Bahreinimotlagh, M.; Kawanisi, K.; Al Sawaf, M.B.; Roozbahani, R.; Eftekhari, M.; Khoshuie, A.K. Continuous streamflow monitoring in shared watersheds using advanced underwater acoustic tomography system: A case study on Zayanderud River. *Environ. Monit. Assess.* **2019**, *191*, 657. [CrossRef]

57. Madani, K. Water management in Iran: What is causing the looming crisis? *J. Environ. Stud. Sci.* **2014**, *4*, 315–328. [CrossRef]